EPA Region 7 TMDL Review

TMDL ID: LP2-20900 **State:** NE
Document Name: ANTELOPE CREEK

Basin(s): LOWER PLATTE BASIN
HUC(s): 10200203
Water body(ies): ANTELOPE CREEK, ANTELOPE CREEK
Tributary(ies): HOLMES LAKE
Pollutant(s): AMMONIA, E. COLI

Submittal Date: 6/26/2007 **Approved:** Yes

Submittal Letter

State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act [40 CFR § 130.7(c)(1)]. Include date submitted letter was received by EPA, date of receipt of any revisions, and the date of original approval if submittal is a phase II TMDL.

Letter for Antelope Creek, dated June 22, 2007, was received by EPA on June 26, 2007, formally submitting this TMDL for approval. Supplemental information was supplied by email on September 10, 2007.

Water Quality Standards Attainment

The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7(c)(1)]. A statement that WQS will be attained is made.

The allowable pollutant load is based upon the available stream flow volume. That is, loading capacities are developed for each flow by multiplying the water quality standard (WQS) by the selected stream flow and a conversion factor (C) with the equation being:

$$\text{Loading capacity} = \text{WQS} * \text{Flow} * \text{C}$$

Defining water body pollutant loading capacity implies a steady state. The determination of a loading capacity for ammonia must consider three key variables: stream flow; pH; and temperature. Rather than restrict the loading capacity to a single flow, a dynamic approach is used. That is, loading capacity isestablished for the entire hydrograph of each season with a load duration curve.

For E. coli the LC is WQS*flow*C during the recreational season.

The numeric targets will result in the attainment of water quality standards.

Numeric Target(s)

Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Assigned Beneficial Uses: Primary contact recreation, warm water aquatic life – class B, agriculture class A and aesthetics (Title 117 – Nebraska Surface Water Quality Standards).

Ammonia WQS

Water quality criteria established for the Class B – Warm water Aquatic Life protection of the beneficial use can be found in Title 117, Chapter 4 and are as follows:

Thirty day average concentrations in mg/l not to exceed the numeric value given by

$$CV = CCC\left(\frac{0.0676}{1=10^{7.688-pH}}+\frac{2.91}{1+10^{pH-7.688}}\right)$$

Where temp is °C and:

CCC = 0.854(Minimum of (2.85 or $1.45*10^{0.028(25\text{-temp})}$))
During periods when early life stages are present (March through October), or
CCC = $0.854(1.45*10^{0.028(25\text{-maximum of temp or }25)}$)
During periods when early life stages are absent (November through February).

E. coli WQS

Segment LP2-20900 was included on Category 5 of the 2006 Integrated Report as having an impaired Primary Contact Recreation beneficial use with the parameter of concern being *E. coli* bacteria. The Primary Contact Recreation beneficial use applies to surface waters which are used or have the potential to be used for primary contact recreation, that includes activities where the body may come into prolonged or intimate contact with the water such that water may be accidentally ingested or sensitive body organs (e.g. eyes, ears, nose) may be exposed.

The WQS for E. Coli bacteria is 126 cfm/100ml geometric mean five samples per 30 day period during the recreational period (May 1 through September 30).

Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC. If submittal is a phase II TMDL there are refined relationships linking the load to WQS attainment. If there is an increase in the TMDL there is a refined relationship specified to validate the increase in TMDL (either load allocation (LA) or waste load allocation (WLA)). This section will compare and validate the change in targeted load between the versions.

Linkage between pollutants of concern and impairments are direct.

Ammonia TMDL

The *Aquatic Life* – Warm water Class B beneficial use assigned to Antelope Creek is not being met (impaired) due to excessive ammonia.

Water quality data assessments were based upon the beneficial use assessment procedures used to identify Category 5/impaired waters for the 2006 Integrated Report. The procedures are based on the application of the "binomial distribution" method that applies a confidence interval to the exceedance rate in an effort to determine the true exceedance of the water body versus the data set. A complete description of the water quality data assessment procedures can be found in the *Methodologies for Waterbody Assessments and Development the 2006 Integrated Report for Nebraska*, NDEQ, January 2006.

For ammonia data collected from 2002-2005, 13 of 64 values exceeded the applicable criteria.

E. coli TMDL

Segment LP2-20900 was included in Category 5 of the submitted 2006 Integrated Report as having an impaired primary contact recreation beneficial use with the parameter of concern being *E. coli* bacteria. This section deals with the extent and nature of the water quality impairments caused by excessive *E. coli* bacteria in the Antelope Creek.

For this TMDL, the source loading is based upon the position of the monitoring data points in relation to the boundary established on the TMDL curve between point source and nonpoint source influences. This process for selecting the load point is described in the document entitled *Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology* (NDEQ 2002).

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered. If this is a phase II TMDL any new sources or removed sources will be specified and explained.

Due to the lake and the watershed's location, much of the land use is urban housing, residential acreages and commercial property. In 1992, 56% of the watershed was considered urban (LPSNRD 1992) and the transition for rural/agriculture to urban has remained steady with the current estimate being 95%. Complete "build-out" of the watershed is expected to occur in 15-25 years.

Based on NDEQ records and information, two point sources discharge or have the potential to discharge to Antelope Creek. Both are industrial facilities with the characteristics of the effluent being truck wash water and cooling water. Both have been issued a National Pollutant Discharge Elimination System Permit (NPDES) (according to EPA's Permit Compliance System) with neither requiring the control or monitoring of ammonia or E. coli. Review of these and other facilities for the pollutant of concern will be conducted during the permit issuance or reissuance process.

The City of Lincoln and the University of Nebraska-Lincoln have been issued MS4 Stormwater permits (NE0133671 and NE0031623 respectively) and are considered point sources and regulated under the NPDES program.

NDEQ identified illicit connections and discharges, combined sewer overflows, sanitary sewer overflows, and straight pipes from septic tanks or other on-site wastewater systems as possible sources of ammonia. While these are potential sources, there have not been investigations to determine the nature and extent of these sources contributions to Antelope Creek.

No animal feeding operations that have been issued State of Nebraska permits, required for construction and operation of livestock waste control facilities (LWCF) if the operation has discharged, or has the potential to discharge, livestock waste to waters of the state have been identified in the Antelope Creek watershed.

The segment of Antelope Creek covered by the TMDL is that below Holmes Lake. The watershed in this area is entirely within the corporate limits of the City of Lincoln and thus covered under the NPDES-MS4 permit. Based on this, nonpoint sources contributions would be minimal if any.

The anaerobic and aerobic breakdown of organic matter can produce ammonia. Natural sources of organic matter are wildlife and the flora in and along the stream and within the watershed.

The primary natural source of *E. coli* is wildlife.

All sources seem to have been accounted for.

Allocation - Loading Capacity

Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2(i)]. If this is a phase II TMDL the change in LC will be documented in this section.

Ammonia TMDL

The load allocations assigned to the ammonia TMDL are based upon the stream flow volume and are defined as:

$$LA_i = Q_i * C_s * C$$

Where:

LA_i = load allocations at the i^{th} flow

Q_i = stream flow at the i^{th} flow

C_s = seasonal ammonia criteria

C = conversion factor

The wasteload allocation is the difference between the loading capacity and the LA/background and is determined by:

$$WLA_i = LC_i - LA_i$$

Where:

WLA_i= wasteload allocation at the i^{th} flow

LC_i = loading capacity at the i^{th} flow

LA_i = load allocations at the i^{th} flow

The LC is expressed as a load duration curve for each season.

As an example at 3.4 cfs (median flow) the LC is 25.7 kg/day in spring, 19.3 kg/day in summer, and 52.1 kg/day in winter.

E. coli TMDL

By regulation, a TMDL requires a loading capacity value for the pollutant of concern. In the case of *E. coli*, a "load" (flow rate x concentration x time) could be calculated, but the NDEQ's considers that may not be appropriate for expressing this non-conservative parameter. Therefore, for the purposes of these TMDLs, a loading capacity is expressed as the water quality standard. Because the water quality is expressed as a concentration, the NDEQ LC will not equal the WLA + the LA.

The load allocations assigned to these TMDLs will be based upon the stream flow volume and will be defined as:

$$LC_i = Q_i * 126/100 \text{ ml} * C$$

Where:

LC_i = load allocations at the i^{th} flow

Q_i = stream flow at the i^{th} flow

126/100 ml = applicable/target water quality criteria for *E. coli*

C = conversion factor

A 10% margin of safety (MOS) means the LC=113/100mL as a 30 day geometric mean during the recreation season.

EPA has calculated a LA at median flow (3.4 cfs) of 10.5×10^7 cfu per day.

WLA Comment

Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.

The City of Lincoln and the University of Nebraska-Lincoln have been issued MS4 Storm water permits (NE0133671 and NE0031623 respectively) and are considered point sources and regulated under the NPDES program. The WLA applies to the sum of all permitted loads.

Ammonia TMDL

Because the watershed is covered under an MS4 permit and source of pollutants is predominantly a point source, the waste load allocation will be calculated by:

$$WLA_i = Q_i * C_s * C$$

Where:

WLA_i = load allocations at the i^{th} flow

Q_i = stream flow at the i^{th} flow

C_s = seasonal median ammonia concentration

C = conversion factor

The WLA is expressed as a load duration curve for each season.

EPA has calculated an example, at 3.4 cfs (median flow) the WLA is 19.6 kg/day in spring, 14.2 kg/day in summer, and 45.1 kg/day in winter.

E coli. TMDL

Title 117 does not allow for the application of a mixing zone for the initial assimilation of effluents in order to meet the criteria associated with the recreation beneficial use. Because of this, the water quality criteria are applied to the "end-of-pipe" concentrations and are applicable at all stream flows >7q10. Therefore, the *E. coli* wasteload allocation established by this TMDL will be a monthly geometric mean 126/100 ml (with a 10% MOS the WLA is 113/100mL). With an MS4 flow of 1 cfs the WLA= 3.1×10^7 cfu per day.

LA Comment

Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II LAs will be documented in this section.

Ammonia TMDL

The load allocation/natural background will also be determined using the established WLA procedures (NDEQ 2001). Similar to pH and temperature, ammonia data will be segregated into seasons and the median value of the data set will be used as the concentration for calculating the LA and background.

The LA is expressed as a load duration curve for each season.

As an example, at 3.4 cfs (median flow) the LA is 6.1 kg/day in spring, 5.1 kg/day in summer, and 7.0 kg/day in winter.

E. coli TMDL

The method chosen to account for the variation in flow is based upon a load duration (TMDL) curve. TMDL curves are initiated by the development a stream's hydrograph using the long-term gage information. The flow information (curve) is then translated into a load curve by multiplying the flow values by the WQS and a conversion factor (C). The acceptable "load" is then plotted graphically.

Therefore, the LC for each of the segments will be defined by:

$$LA = WQS * Flow * C$$

(with a 10% MOS the LA is 113/100mL).
At median flow with no stormwater runoff (WLA=0), the LA= 10.5×10^7 cfu per day.

There was no allowance for future growth included in these TMDLs.

Margin of Safety

Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.

Ammonia TMDL

A MOS must be incorporated into TMDLs in an attempt to account for uncertainty in the data, analysis or targeted allocations. The MOS can either be explicit or implicit and for this TMDL are as follows:

Implementation of controls will target the storm water as a whole rather than just the monitoring data where violations are noted. This action will reduce the pollutant load as a whole,

The MOS for this TMDL is implicit.

E. coli TMDL

A margin of safety (MOS) must be incorporated into TMDLs in an attempt to account for uncertainty in the data, analysis or targeted allocations. The MOS can either be explicit or implicit.

To account for uncertainty in the nonpoint source load reduction, the targeted reductions will be set at 90% of the water quality target (126/100 ml). Specifically the reductions shall be applied to meet a seasonal geometric mean of less than 113/100 ml. At an MOS of 13 cfu/100 mL at median flow the explicit MOS=10.5×10^6 cfu per day.

The MOS for this TMDL is explicit.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL (s) [40 CFR § 130.7(c)(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.

Ammonia TMDL

Nebraska WQS establish two periods that are commonly referred to as "early life stage present" (March through October) and "early life stage absent" (November through February). Implementation of the NPDES program further separates the early life stage present period to account for variability in stream flows and physical (Temperature) and chemical (pH) conditions of water bodies.

The environmental conditions for this TMDL are based upon the seasons being used by the

NPDES program in the regulation of ammonia. Those seasons are: spring (March-May); summer (June-October); and winter (November-February).

E. coli TMDL

The water quality criteria associated with the Primary Contact Recreation beneficial use only applies from May 1 through September 30. Therefore, the critical conditions for these TMDLs will be those occurring from May 1 through September 30.

Public Participation

Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].

The availability of the TMDLs in draft form was published in the Lincoln Journal-Star with the public comment period running from approximately May 14, 2007 to June 18, 2007. These TMDLs were also made available to the public on the NDEQ's Internet site and interested stakeholders were informed via email of the availability of the draft TMDLs. No comments were received during the public participation period.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].

Future monitoring of Antelope Creek will be completed through the NDEQ ambient stream program for ammonia and through the basin rotation program for *E. coli* bacteria. Streams sites in the ambient program are monitored twice monthly from April through September and once monthly from October through March.

In 2009, basin rotation monitoring will once again be conducted in the Lower Platte Basin. Stream sites are monitored weekly from May through September.

Recently, analytical techniques have been introduced that may provide a greater level of confidence in the identification of pollutant sources. These techniques include microbial source tracking and specialized sampling the targets human wastewater. As the science progresses the application of these analytical techniques may become a valuable tool for source identification and pollutant reduction.

Reasonable Assurance

Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.

The NDEQ is responsible for the issuance of NPDES or state operating permits for industrial and municipal wastewater discharges, and regulated storm water discharges. Issued permits must be consistent with or more stringent than the wasteload allocations set forth by these TMDLs, as explained in EPA guidance. As well, the issued permits must include measurable goals to reduce the discharge of pollutants set forth by the TMDL. Compliance with the permit may require the WLA be addressed through post construction BMPs or other measurable goals. Because more stringent LA reductions are not being used in lieu of less stringent WLAs reasonable assurances are not required.